



THYROID GLAND (2)

INTENDED LEARNING OBJECTIVES (ILO)



By the end of this lecture the student will be able to:

1. Differentiate between abnormal thyroid hormone secretion before and after puberty.
2. Explain the tachycardia associated with increased secretion

Disturbances of thyroid gland function

Disturbance in thyroid function may be either: hypofunction: **hypothyroidism** or hyperfunction: **hyperthyroidism**. In either condition, it is classified into:

Primary: if the disease is thyroid in origin.

Secondary: if the disease is pituitary in origin.

Tertiary: if the disease is hypothalamic in origin.

HYPOTHYROID

Due to deficient secretion or decreased effects of thyroid hormones. **Causes are:**

I- Thyroidal:

a-Congenital: absence of the thyroid gland or defects in the biosynthesis of thyroid hormones.

b-Maternally transmitted: mothers taking antithyroid drugs or excessive iodides depress the thyroid gland of the fetus.

c- Chronic iodine deficiency: it is now rare, due to supplementation of table salt with iodides.

d- Iatrogenic: excessive antithyroid drugs or over remove thyroid tissue surgically, or over destroy thyroid tissue by an overdose of radioactive iodine in cases of hyperthyroidism.



e- Chronic thyroiditis: due to destruction of thyroid tissue by viruses or antibodies (autoimmune thyroiditis). (TSH-R[block] Ab, Tg Ab, TPO Ab)

II- Suprathyroidal :

- Pituitary causes (secondary).
- Hypothalamic causes (tertiary)

Symptoms and effects on the body

I. General effects:

- Decreased calorogenesis, BEE, body temperature & increased susceptibility to cold weather.
- Increased body weight and accumulation of subcutaneous mucoproteins & mucopolysaccharides causing non-pitting edema.
- The skin is coarse & dry.
- Generalized decreased in activity of all body systems: cardiovascular (bradycardia & decreased C.O.), respiratory (brachypnea), gastrointestinal (decreased motility & constipation).

II. According to the age

a- Cretinism: it occurs in children since birth or during early childhood.

1- Special facial features: Wide nasal bridge, enlarged lips with a protruded tongue and some body characteristics: abdominal bulging with an umbilical hernia & a supraclavicular pad of fat, in addition to a general delay in all developmental criteria.

2- Delayed mentally (Idiot): the infant is unable to learn in the proper age (IQ is very low) in addition to the inability to sit, to stand, to walk, to speak, to control his urine & stools.



3- Delayed physically: (Dwarf) he is short in height, his fontanel's close & teeth erupt later than normal i.e. the **milestones of growth are delayed.**

4- Delayed sexually: if he lives to adult age, he is **sexually infantile: impotent & sterile.**





b - Myxedema: the adult patient is characterized by: -

The patient hates winter and is susceptible to cold.

Mental functions are depressed: he is apathetic & drowsy with a prolonged reaction time.

A special husky voice & absent outer 1/3 of the eye brows.

Sexual functions are depressed due to slight atrophy of the gonads.

III. Lab findings

- o Increased level of cholesterol in plasma.
- o Low T₃ & T₄ with high TSH in blood (thyroid origin).
- o Low T₃ & T₄ with low TSH in blood (pituitary or hypothalamic origin).

HYPERTHYROIDISM: THYROTOXICOSIS

It occurs in adults. This disease is due to excessive secretion of thyroid hormones. Its causes are:

A- Thyroid overactivity:

- 1-Acute thyroiditis:** irritates the thyroid to secrete excess hormones.
- 2-Tumor or nodules** in the thyroid gland secrete excess T₃ & T₄.
- 3-Grave's disease: auto antibodies** against the **TSH receptors** of the thyroid cells: **TSH-R [stim] Ab**. The TSH receptors stimulated by the antibodies are not controlled by TRH.

B- Suprathyroid overactivity:

A thyrotrope pituitary tumor.

Resistance of the thyroid receptors in the pituitary (gene mutation). The pituitary secretes TSH unopposed by the normal negative feed back effect of the thyroid hormones.

C - Extrathyroidal activity:

Ectopic thyroid tissue, produce extra amounts of T₃ & T₄.

Excessive administration of thyroid hormones by error.

Symptoms and effects on the body

1- Increased BEE (+ 60% to + 100%) a warm, flushed and sweaty skin. The patient does not tolerate hot weather.



2- loss of body weight: the increased energy gain by the **increased appetite and hyperphagia** is smaller relative to the increased energy loss.

3- Increased excitability of the nervous system. The patient is irritable with nervousness & fine tremors of the extended and abducted fingers, due to increased response of the reticular activating system (RAS) to the circulating catecholamines.

4-Heart rate and CO are increased. Tachycardia is due to:

- Direct stimulation of the SAN.
- Thyroxine sensitizes the SAN to catecholamines.
- The increased metabolism leads to increased venous return and reflex tachycardia (**Bainbridge reflex**).

5-The systemic arterial blood pressure shows:

A rise in the systolic, due to increased stroke volume & CO.

A drop in the diastolic: due to peripheral vasodilatation.

Increased pulse pressure (increased systolic pressure & decreased diastolic pressure).

6-Exophthalmos: it is the protrusion of the eyeballs; it may be present in some patients.

Cytotoxic autoantibodies are formed against the **extraocular muscles** and the thyroid gland. These antibodies attack and cause **hypertrophy of the extraocular muscles and the retro-orbital connective tissues** and push the eye ball forward. In late conditions, excessive hypertrophy of these muscles press on the optic nerve and may cause optic atrophy and blindness.



Laboratory findings

The thyroid hormones: T_3 and T_4 and the pituitary TSH may be:

High T_3 and T_4 with low TSH: in the following cases: thyroiditis hypersecreting thyroid nodules, ectopic thyroid tissue and Grave's disease (Thyroidal & extrathyroidal)

High T_3 & T_4 with high TSH: in the following cases: pituitary thyrotrope tumor, mutation of the thyroid hormone receptors in the anterior pituitary. The mutated receptors are resistant to the normal T_3 & T_4 and so over secrete TSH (Suprathyroidal).



Goiter

Goiter: is **enlargement of the thyroid gland.** It is used clinically to indicate that an enlarged thyroid is associated with either: normal, decreased or increased thyroid activity.



Types:

A - Physiological: during puberty & pregnancy in females. The thyroid cells and follicles enlarge, to secrete more thyroid hormones, to supply the body with the generalized increased needs in body metabolism.

B - Hypothyroidism: the thyroid follicles are full of TG. It occurs in: Iodine deficiency (thyroid hormones are not formed).

C - Hyperthyroidism: the thyroid cells increase in size & number. Thyroid tumor (adenoma).

Autoimmune(**TSH-R[stim] Ab**) abnormal stimulation (Grave's disease)
Secondary stimulation in response to a pituitary tumor.

D - Nodular goiter: in the form of multiple enlarged nodules. The thyroid nodules may be hot (active) or cold (inactive).



MULTI NODULAR GOITRE